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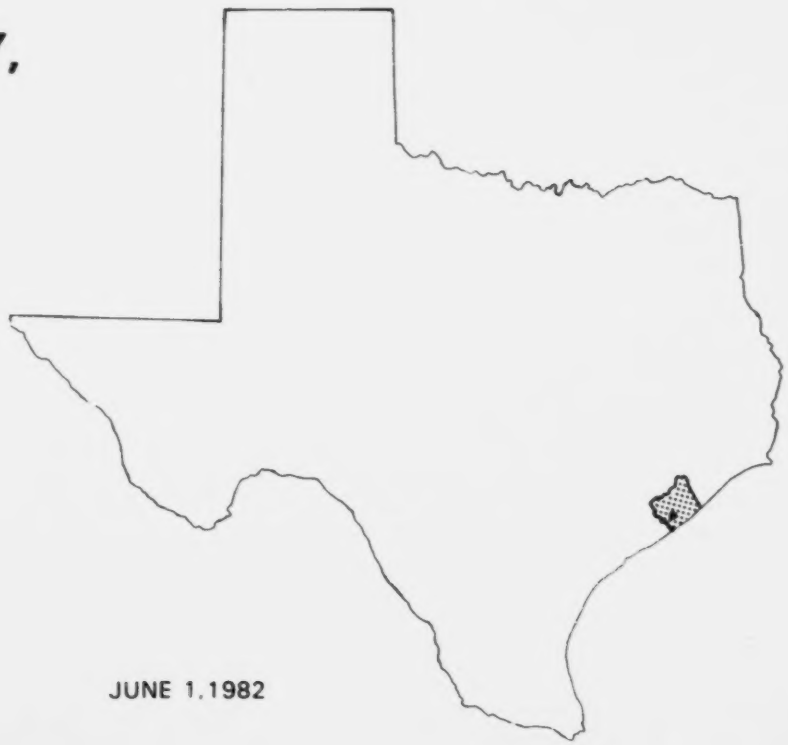
FLOOD INSURANCE STUDY

CITY OF SWEENY, TEXAS
BRAZORIA COUNTY



JUNE 1, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 485512

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
CITY OF SWEENY, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Sweeny, Brazoria County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of the information will be to maintain the City of Sweeny in the regular program of the Flood Insurance by the Federal Emergency Management Agency (FEMA). The City of Sweeny had been converted to the regular program on December 17, 1971. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Woodward-Clyde Consultants for the Federal Emergency Management Agency, under Contract No. H-4787. This study was completed in June 1980.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the study contractor, FEMA, and representatives of the City of Sweeny in May 1978.

On January 21, 1982, the results of the study were reviewed at a final meeting attended by representatives of the study contractor, FEMA and the community.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the City of Sweeny, Brazoria County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The limits of detailed and approximate studies in Sweeny were determined by FEMA with community and study contractor consultation at the meeting in May 1978.

Floods caused by overflow of Stevenson Slough in the western corner of the corporate city limit extend downstream through the central part of the city extending east to the corporate city limits. This flood prone area was studied in detail.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction through June 1980.

2.2 Community Description

The City of Sweeny is located in the southeastern coastal plain of Texas, in the southwestern portion of Brazoria County. It is situated approximately 60 miles southwest of Houston, Texas. According to U. S. Census figures, the population of Sweeny is estimated to be 4100.

Stevenson Slough originates west of corporate city limits south of State Highway 35 and the Old Ocean Tank Farm. The slough generally flows in a southerly direction for approximately five miles and then turns east flowing through the city ultimately emptying into the San Bernard River. Approximately 8.7 square miles correspond to the drainage area of Stevenson Slough.

Approximately 75 percent of the township has been developed, with the remainder of land vacant, covered with grasses and some trees and bushes. Development consists mainly of single family dwellings with a few private businesses.

2.3 Principal Flood Problems

The past history indicates that flooding within the City of Sweeny may occur during any season of the year. Storms occurring during the summer months are often associated with tropical storms moving inland from the Gulf of Mexico.

Detailed information associated with various flooding events is unavailable, no USGS gages or monitor systems are maintained. The City of Sweeny is subject to flooding predominantly from Stevenson Slough in the west,

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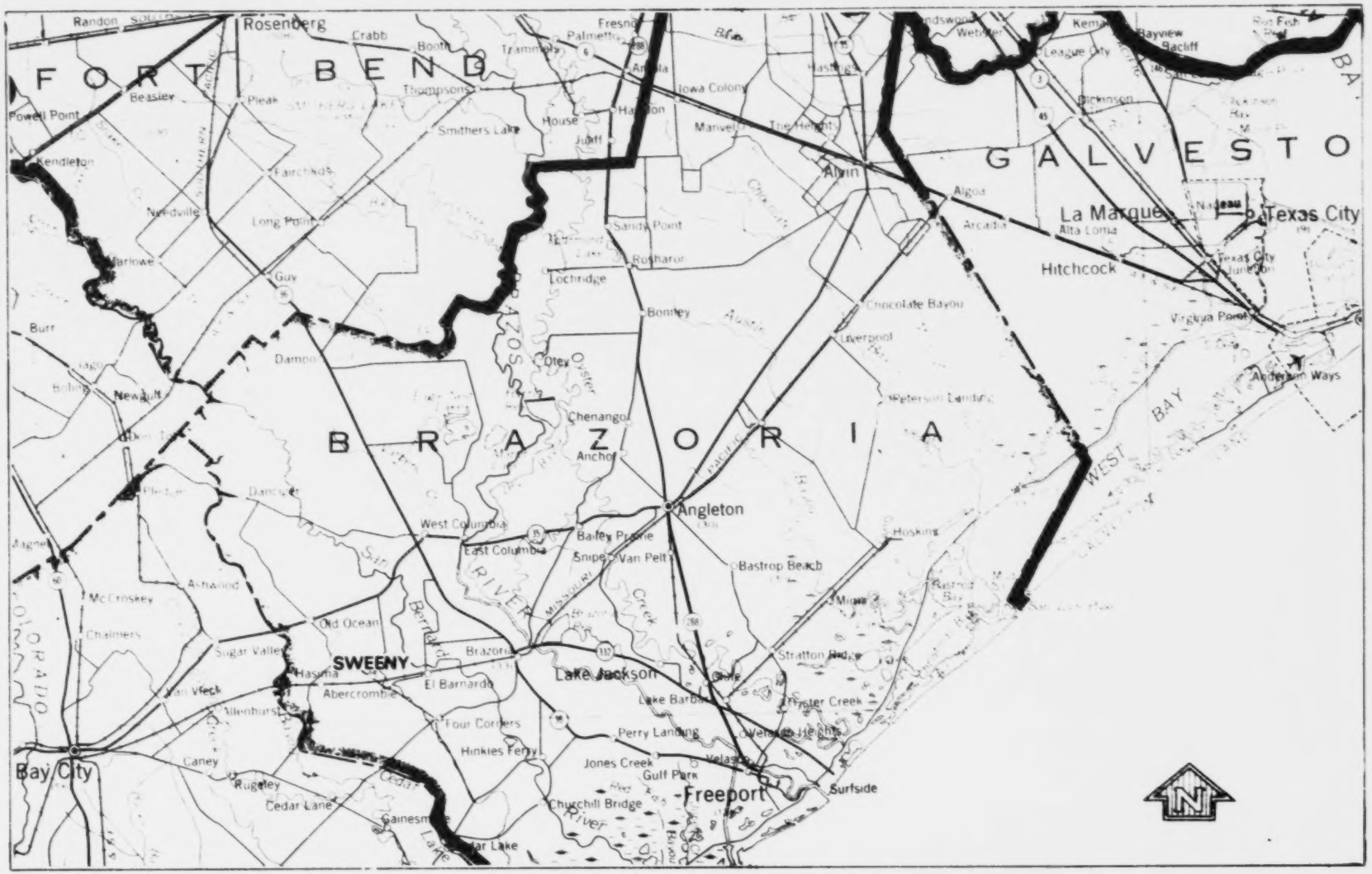
FORT BEND
BRAZORIA
GALVESTO
Rosenberg
Sugar Land
Stafford
Missouri City
Pearland
Alvin
Angleton
Lake Jackson
Freeport
Clute
Surfside
SWEENY
Bay City
Brazoria
West Columbia
Angleton
Lake Jackson
Freeport
Clute
Surfside
Bay City
SWEENY

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central and eastern portions. Some flooding occurs along the southern boundary of the city limits resulting from ponding effects on Cocklebur Slough, which orginates in that area. Flooding on the Stevenson Slough results from insufficient flow capacity through the structures and backwater effects caused by the San Bernard River.

2.4 Flood Protection Measures

No special flood protection increases were noted during the field inspection of the Stevenson Slough system. Some drainage improvement are carried out under the direction of the city.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

Flood discharges for the detailed study of Stevenson Slough were based on USGS Report 77-110, "Technique for Estimating the Magnitude and Frequency of Floods in Texas", a regional method based on regression analyses (Reference 1). The method relates drainage area and channel slope to peak discharge by empirical equations developed for six designated regions in Texas.

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A summary of drainage area-peak discharge relationships for the stream studied in detail is shown in Table 1, "Summary of Discharges".

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
STEVENSON SLOUGH					
Country Road 321	0.9	110	120	120	140
East Corporate City Limit	1.6	380*	540*	600*	770*
County Road 332	2.3	400	600	680	860
Upstream of Salt Water Canal	2.5	430	640	730	930
Confluence point with Salt Water Canal	8.5	1,200	2,000	2,400	3,100
Confluence with San Bernard River	8.7	1,200	2,100	2,500	3,300

*Includes adjustment for urbanized conditions.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the City of Sweeny were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

Cross sections for the backwater analyses of Stevenson Slough were obtained by the surveying subcontractor. This surveying effort included data on the overbank areas and all bridge and culvert crossings throughout the city limits.

Locations of selected cross sections used in the hydraulic analysis are shown on the Flood Profiles. For the stream segment for which a floodway was computed, selected cross-section locations are also shown on the Flood Boundary and Floodway Map.

Channel roughness factors (Manning's "n") used in the hydraulic computations, were chosen by engineering judgement and based on field observations of the channel and overbank conditions. Roughness factors for the main channel of Stevenson Slough range from 0.03 to 0.087 with the flood plain roughness values ranging from 0.055 to 0.064 for all floods.

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Water-surface elevations of floods of the selected recurrence intervals were computed using the U. S. Army Corps of Engineers (COE) HEC-2 generalized computer program (References 2 & 3). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations were calculated using the slope-area method. All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:12,000 with a contour interval of 5 feet. In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

The boundaries of the 100 and 500-year floods are shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may lie above the flood elevations, and therefore, may not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain manage-

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ment. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map, the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Stevenson Slough								
G	12,053	98[2]	392	1.6	26.6	26.6	27.3	0.7
H	13,485	115	632	0.4	27.0	27.0	28.0	1.0
I	13,723	119	565	0.5	27.0	27.0	28.0	1.0
J	14,089	53	185	1.5	27.1	27.1	28.1	1.0
K	14,501	143	554	0.5	27.2	27.2	28.2	1.0
L	14,731	75	214	1.3	27.2	27.2	28.2	1.0
M	15,432	75	182	1.5	28.0	28.0	28.6	0.6
N	15,693	33	124	2.2	28.3	28.3	29.2	0.9
O	16,047	89	192	1.4	28.9	28.9	29.8	0.9
P	16,513	75	217	1.2	29.6	29.6	30.4	0.8
Q	17,984	34	111	1.2	30.3	30.3	31.2	0.9
R	18,220	145	566	0.2	31.8	31.8	32.6	0.8
S	18,420	145	567	0.2	31.8	31.8	32.6	0.8
T	20,148	88[2]	343	0.4	31.9	31.9	32.7	0.8
U	21,274	222[2]	2,112	0.1	36.6	36.6	37.4	0.8
V	22,124	240	1,565	0.1	36.6	36.6	37.4	0.8
W	22,809	230[3]	1,663	0.1	36.7	36.7	37.4	0.8
X	23,029	230[2]	1,600	0.1	36.7	36.7	37.5	0.8
Y	24,966	218[2]	1,642	0.1	36.7	36.7	37.5	0.8

[1]Feet above mouth
[2]Outside corporate limits
[3]Extends beyond corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SWEENY, TX
(BRAZORIA CO.)

FLOODWAY DATA

STEVENSON SLOUGH

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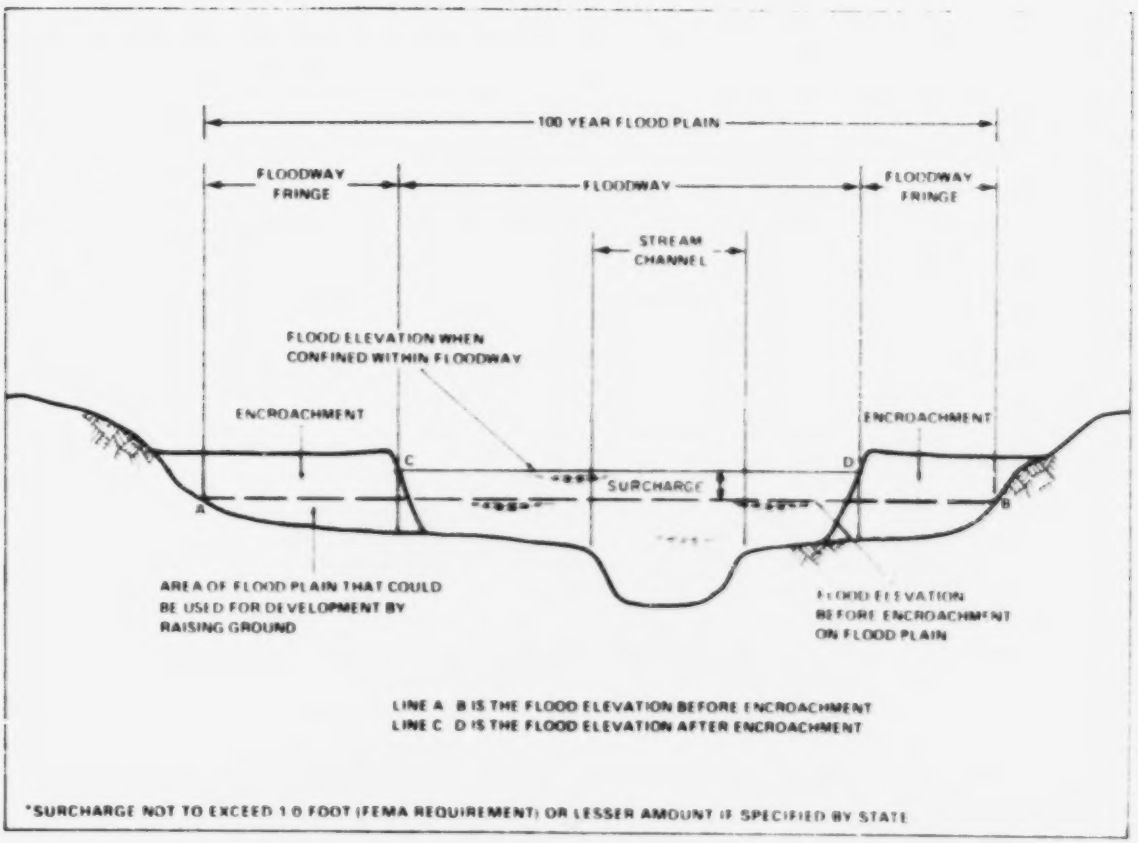
100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 2

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each significant flooding source affecting the City of Sweeny.

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5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

Two reaches meeting the above criteria were required for the flooding sources of Sweeny. The location of the reaches are shown on the Flood Profiles.

5.2 Flood Hazard Factors (FHFs)

The Flood Hazard Factor is used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between the water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the incorporated areas of the City of Sweeny were divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zones A1 & A2: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHFs.

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Zone AO:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown, but no Flood Hazard Factors are determined.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Sweeny is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

The current Flood Insurance Rate Maps for the City of Sweeny are based on approximate methods and mapped by Michael Baker, Jr. This map shows a base flood elevation but does not indicate a floodway delineation (Reference 4).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region VI, Federal Center, Denton, Texas 76201.

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8.0 BIBLIOGRAPHY AND REFERENCES

1. U.S. Geological Survey, Water-Resources Investigation 77-110, Open-File Report, Technique for Estimating the Magnitude and Frequency of Floods in Texas, 1977, E. E. Schroeder and B. C. Massey.

2. U.S. Army Corps of Engineers, Hydrologic Engineering Center, Computer Program 723-02A HEC-2 Water-Surface Profiles, August 1979, Users Manual.

3. U.S. Army Corps of Engineers, Hydrologic Engineering Center, Application of the HEC-2 Bridge Routines, June 1974, Training Document No. 6.

4. U.S. Department of Housing and Urban Development, Federal Emergency Management Agency, Flood Insurance Study Guidelines and Specifications for Study Contractors, October 1977.

Chow, Ven T., Open Channel Hydraulics, McGraw-Hill Company, 1959.

U.S. Department of Agriculture, Soil Conservation Service, Flood Insurance Study, Sweeny, Texas, Type 10 Study, September 1971.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3]
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Stevenson Slough							
Reach 1	0002	-1.11	-0.26	+0.66	010	A2	Varies
Reach 2	0001,0002	-0.32	-0.06	+0.08	005	A1	-
Shallow Flooding							
Sheet Flow	0002	*	*	*	*	AO	Depth 1 Foot

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT-SEE MAP

*Not Applicable

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SWEENY, TX
(BRAZORIA CO.)

FLOOD INSURANCE ZONE DATA

STEVENSON SLOUGH-SHALLOW FLOODING

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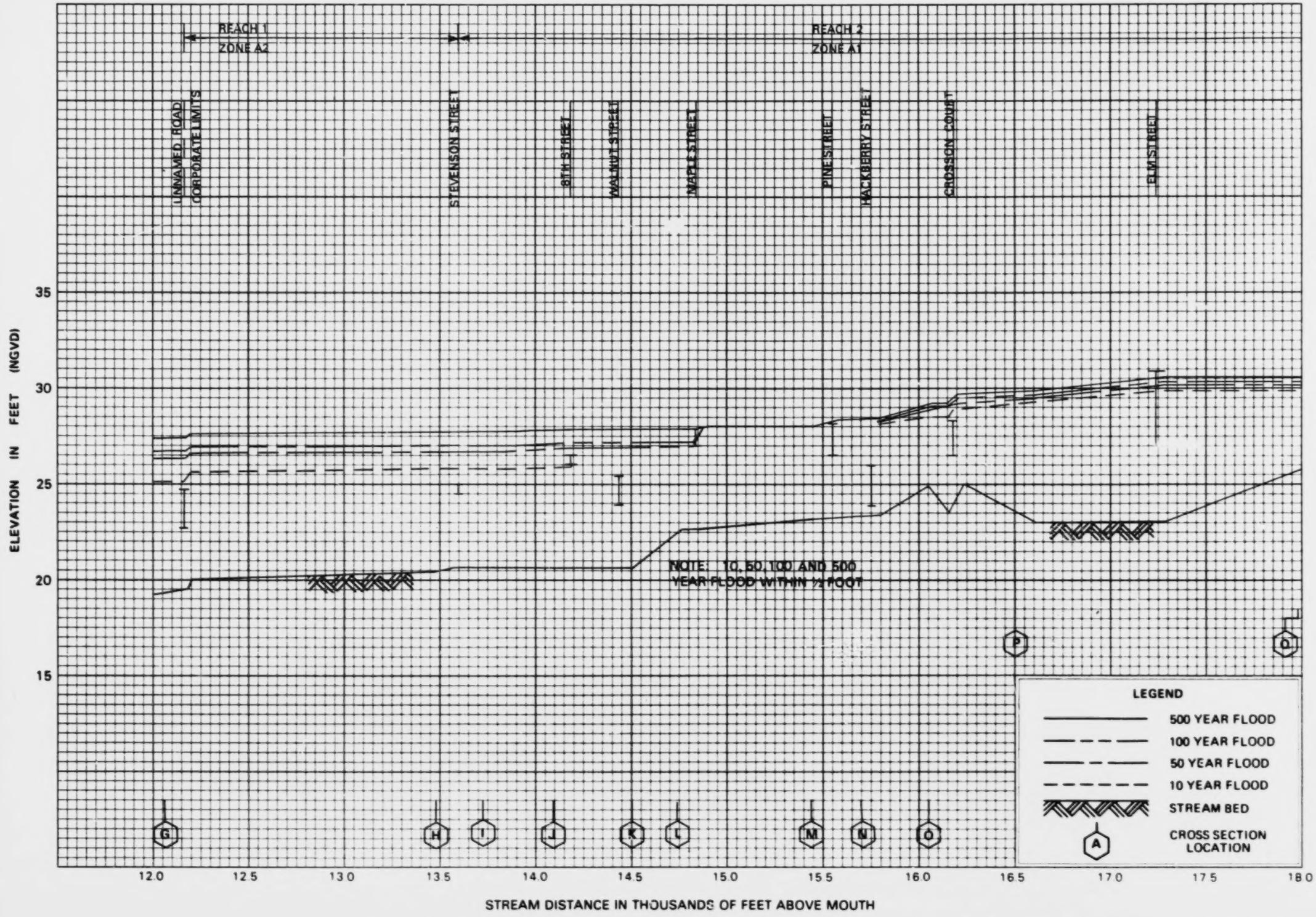

FLOOD PROFILES

STEVENSON SLOUGH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SWEENY, TX
(BRAZORIA CO.)

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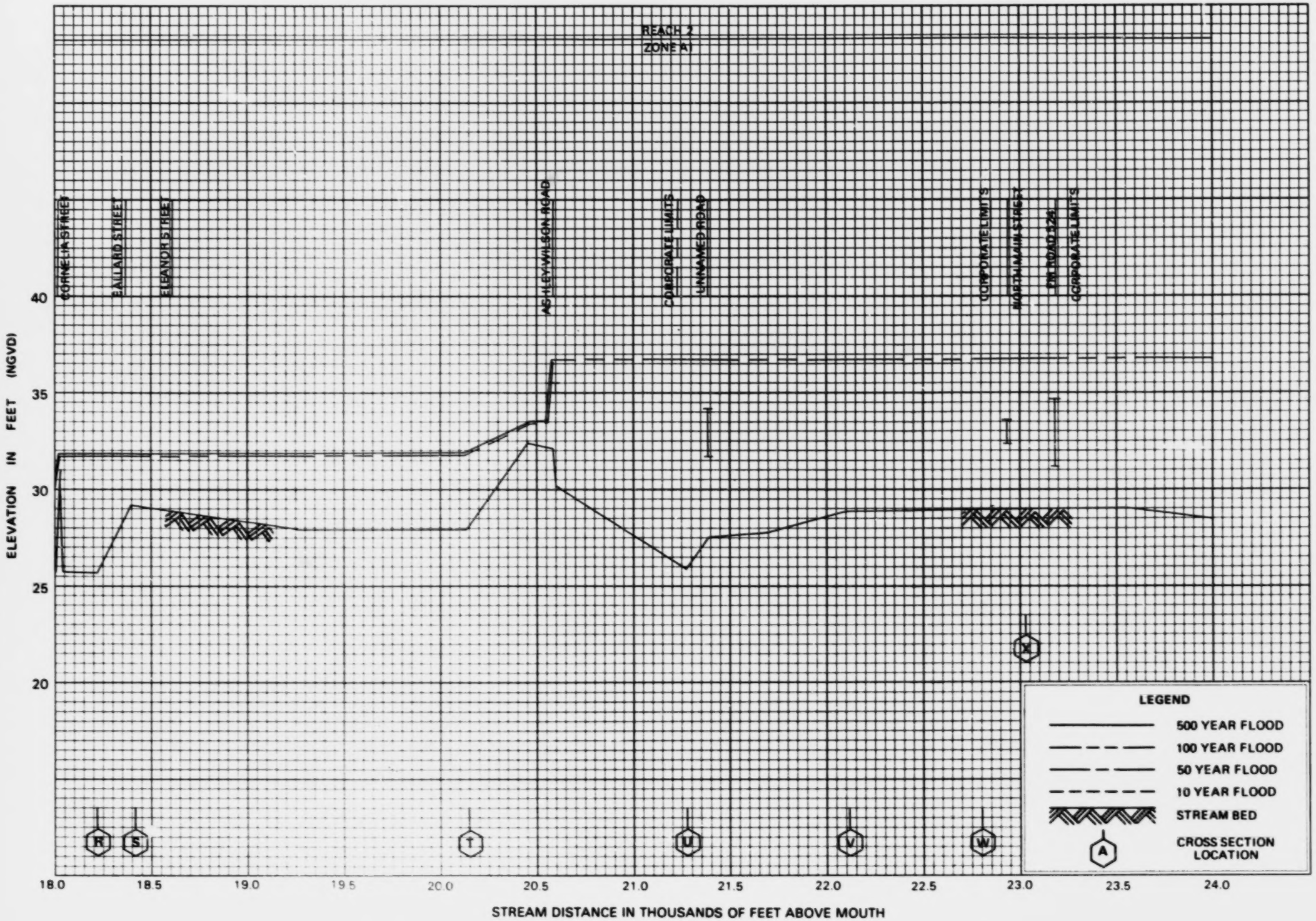

FLOOD PROFILES

STEVENSON SLOUGH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SWEENY, TX
(BRAZORIA CO.)

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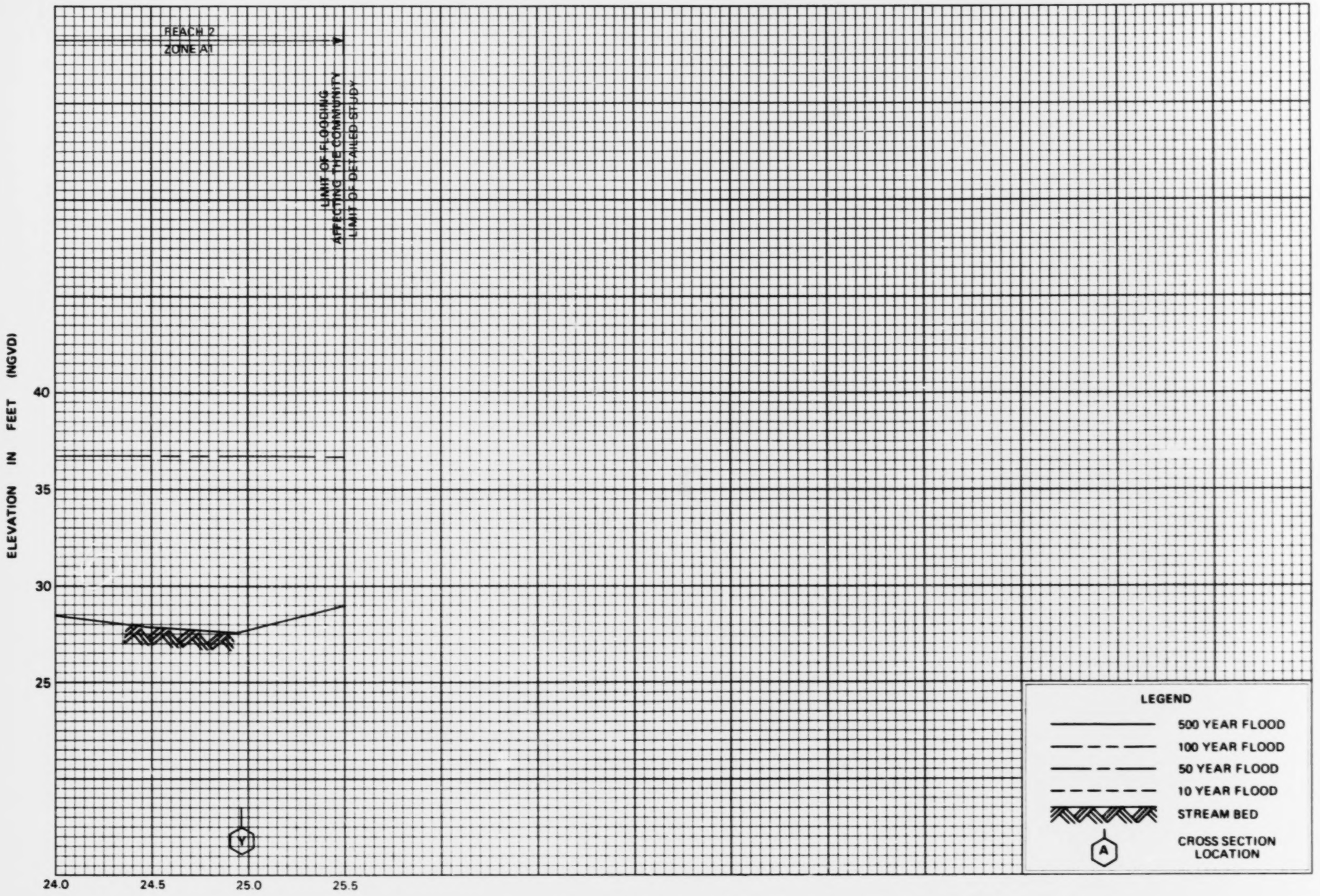

FLOOD PROFILES

STEVENSON SLOUGH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF SWEENY, TX
(BRAZORIA CO.)

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